**Name of student: ……** **Stage: First**

**Lecture Name: Tissue Microtom** **Number: 7**

**Date: 12 / 5 / 2025** **Time: 8:30 AM** **Place: BC 208**

**Microtome: is the instrument which is used to cut thin section of tissue. Microtome are machines that will advance an object for a predetermined distance then slide the object to the cutting tool.**

**Microtome:- is a device used to cut extremely thin slices of material, known as sections. Important in science. Microtomes are used in microscopy, allowing for the preparation of samples for observation under transmitted light or electron radiation.**

**Microtomy: used to prepare a thin sections for materials such as bones, minerals and teeth and intestine. Microtome sections can be made thin enough to section a human hair across its breadth, with section thickness between 50 nm and 100 µm.**

**Factors Involved in Cutting:**

**1. Temperature: Lowering the temperature facilitates section cutting.**

**2. Angle of rake: Higher rake angle helps in smooth flow of ribbons. Lower rake angle is used for hard tissue.**

**3. Consistency of tissue: Soft tissue is cut at a slow rate than the hard tissue. Sectioning the Paraffin Block:**

**The following instruments are essential for section cutting:**

**1. Microtome with blade**

**2. Water bath**

**3. Paraffin block with embedded tissue to cut**

**4. Ice tray**

**5. A blunt forceps or camel brush**

**6. Slide rack with slide.**

**Applications of a Microtome:**

1. **Histology and Pathology:**

- **Preparation of tissue sections from biological samples (e.g., human or animal organs) for examination under a microscope.**
- **Used to diagnose diseases by examining stained tissue samples.**

2. **Botany:**

**Cutting thin sections of plant tissues for studying internal structures such as vascular bundles, xylem.**

**3- Cytology:**

- **Obtaining thin cell layers to observe cellular morphology and structure.**

**4-Neuroscience:**

- **Slicing brain tissues to study neural pathways and brain anatomy.**

**5- Forensic Science:**

- **Analyzing tissue samples in forensic pathology investigations.**

**6-Material Science:**

- **Creating thin sections of materials like polymers or metals (when embedded in resin) for structural analysis using electron microscopy.**

**7- Pharmaceutical Research:**

- **Studying the effect of drugs on tissue morphology and structure.**

## TYPES OF MICROTOME:

**There are several types of microtome each designed for a specific purpose although many have a functional role. Excluding ultra microtome, there are 6 basic types. named according to the mechanism.**

1. **Rotary microtome**
2. **Rocking microtome**
3. **Ultra microtome**
4. **Vibrating microtome**
5. **Saw microtome**
6. **Sliding microtome**
7. **Freezing microtome**

## 1- ROTARY MICROTOME

**Rotary microtome: This is the most commonly used microtome in routine laboratory. The cutting blade is kept in horizontal position, and the block containing tissue moves up and down with the help of rotary handle attached with the microtome. In each 360° rotation of the wheel handle, the block moves down followed by up, and the tissue is cut as thin ribbon.**

**Parts of Rotary microtome:**

**Block holder**

**Knife clamps**

**Thickness gauge**

**Operating handle**

**Knife clamps screws**

**Block adjustment**

**Angle of total adjustment**

**Internal and external lock**

## 2- ROCKING MICROTOME

This is one of the oldest designs of the microtome. The microtome can cut thin section with ribbons and is ideal for serial section. The sections are slightly curved in this microtome.

• The Cambridge rocking microtome was the most popular microtome.

• In this microtome knife is fixed &the block of the tissue moves through an are to strike knife.

**DISADVANTAGES**

1. The size of the block that can be cut is limited.
2. It is a lighter microtome, so it vibrates white cutting.
3. The cutting angle of the knife cannot be adjusted.
4. The sections cut curved when the block moves through an arc.
5. No serial section is possible.

## 3- Ultra microtome:

Ultra microtome is used to cut ultrathin sections for transmission electron microscopy. Sections are cut between 40 and 100 nanomicron thickness with the help of glass knife or diamond knife.

**Advantages of Ultra microtome:**

1. **Ultra-thin sectioning**:Can produce sections as thin as 50–100 nanometers, essential for TEM.
2. **High precision**:
3. **Smooth surface finish**:
4. **Compatible with various materials**:
5. **Essential for ultrastructural studies**.

**Disadvantages of Ultra microtome:**

1. **High cost**: are expensive.
2. **Time-consuming preparation**: Samples require extensive preparation, including fixation, dehydration, embedding, and trimming.
3. **Requires skilled operation**:
4. **Delicate equipment**:

## 4- Vibrating microtome:

(also called a **vibratome**) is used to cut thin sections of soft, unfixed or lightly fixed tissues, especially in **neuroscience, physiology, and pathology**. It uses a vibrating blade to slice tissue gently, minimizing damage. The vibrating microtome is usually used for difficult biological samples. The cut thickness is usually around 30–500 μm for live tissue and 10–500 μm for fixed tissue.

**Advantages of Vibrating Microtome.**

1. **Preserves tissue viability**.
2. **Minimal structural damage**.
3. **No embedding required**: Saves time and avoids chemical processing steps like paraffin embedding.
4. **Thicker sections possible**.
5. **Suitable for delicate tissues**.

**Disadvantages of Vibrating Microtome:**

1. **Lower resolution than ultra microtomes**:

Cannot produce ultra-thin sections (e.g., <10 μm) needed for electron microscopy.

2. **Less consistent section thickness**:

Thickness may vary slightly due to vibration or tissue inconsistency.

3. **Slower cutting speed**:

Cutting is generally slower than with rotary or ultramicrotomes.

4. **Limited for hard tissues**:

Not suitable for highly calcified or resin-embedded specimens.

5. **Maintenance and alignment**:

Blade angle and vibration settings need frequent adjustment for optimal results.

## 5- Saw microtome:

The saw microtome is especially for hard materials such as teeth or bones. The microtome of this type has a recessed rotating saw, which slices through the sample. The minimal cut thickness is approximately 30 μm and can be made for comparatively large samples.

**Advantages of Saw Microtome:**

1. **Cuts hard tissues**:

Ideal for bone, teeth, and other mineralized or resin-embedded samples.

2. **Preserves structure**:

3. **Thick sectioning possible**:

Can produce sections of various thicknesses, including thicker sections for imaging or grinding.

4. **No need for decalcification**:

Maintains original mineral structure, useful for histology, pathology, and material science.

**Disadvantages of Saw Microtome:**

1. **Lower precision for thin sections**.
2. **Produces heat and debris**.
3. **Expensive equipment and maintenance**.
4. **Section surface may need polishing**.

**6- sliding microtome**: is a type of microtome commonly used for sectioning **large, hard tissue blocks**, such as **wood, bone, or plant specimens**, often embedded in paraffin or resin. Unlike rotary microtomes, the **knife in a sliding microtome moves horizontally over a stationary specimen block**.

**Microtome Care and Maintenance:**

**1. Before Use:**

- ❖ Ensure the microtome is clean and properly assembled.
- ❖ Check blade sharpness; replace dull blades to avoid tissue damage and accidents.
- ❖ Verify that the specimen is properly embedded and securely clamped.

**2. During Use:**

- ❖ Never touch the blade edge with fingers always use forceps or a brush.
- ❖ Adjust thickness settings carefully to avoid jamming or uneven sections.
- ❖ Lock the hand wheel when the microtome is not in use, even briefly.

**3. After Use:**

- ❖ Clean the microtome thoroughly: remove tissue debris, paraffin, and dust.

- Safely remove and dispose of used blades using a blade disposal container.
- Wipe down all surfaces with a lint-free cloth; avoid water on metallic parts.